SEMESTER: S7

POLYMERS AND SEPARATION PROCESSES

Course Code	**PEPOT752**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To impart the basic concepts of separation process.

2. Develop knowledge on recent advances in separation techniques

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	Characteristics and selection of separation process: Importance and variety of separation, economic significance, inherent separation factor, selection, factors influencing the choice of separation process, solvent selection, selection of equipment. Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Rate based versus equilibrium separation processes, Selection of separation process, Energy requirements of separation processes. Polymer materials used as membranes, functional polymer membranes	**9**
2	Introduction, Type and choice of membranes, Plate and frame, tubular, spiral wound and hollow fibre membrane reactors and their relative merits, Membrane filtration, Microfiltration, Nanofiltration, Ultrafiltration, Reverse Osmosis, Dialysis, Models for membrane separations.	**9**

	Basic principles, classifications, Surfactants at Inter phases and in bulk, Foam fractionation, Foam flotation, Adsorptive bubble separations, Ion flotation, Microemulsion/Macro emulsions, Hydro topes, Solvent ablation	
3	Interacting solutes, Adiabatic adsorbers, velocity effects. Adsorption-Desorption operations: Thermal desorption of gases, activated carbon solute recovery, processing liquid using thermal regeneration, Pressure swing and vacuum swing adsorption, Regeneration with purge and desorbent. Basics of Ionex change, Ionex change resins, Binary ion exchange equilibrium, Ion movement theory, Applications, Applications without exchange: Ion exclusion, Mass transfer in ion exchange systems	**9**
4	Introduction, types of chromatography, Elution chromatography: Principles and Retention theory, Band broadening and separation efficiency, Types of chromatography, large scale elution (cyclic/batch) chromatography, Selective adsorption of biological macromolecules, Simulated counter current techniques, Comparison with other separation methods.	**9**

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Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Summarize the factors influencing the choice of separation techniques.	**K2**
CO2	Develop models and the solutions for membrane separation processes	**K6**
CO3	Compare the surfactant and adsorption-based separation	**K5**
CO4	Categorise the treatment of process liquids by ion exchange process and its applications	**K4**
CO5	Define the treatment of process liquids by Chromatographic Separations and its applications	**K1**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											
CO2	**3**											
CO3	**3**											
CO4	**3**											
CO5	**3**											

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Separation Process Principles	Seader, J D, and Ernest J Henley	New York Wiley	1998
2	Basic Principles of Membrane Technology	Marcel Mulder	Springer	2007
3	Separation Processes	King C.J.;	Tata McGraw–Hill	1982.
4	Rate-Controlled Separations	Wankat, P.C	Springer,	1994

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Membrane Technology in the chemical industry	Nunes S P, Peinemann K V	Wiley-VCH	2nd, 2006
2	Membrane Process	Rautanbachand Albrecht R	John Wiley and Sons..	1989
3	Membrane Processes in separation and Purification	Crespo. J G, Bodekes KW	Kluwer Academic	1994.
4	Transport processes and Unit Operations	Geankoplis C J	PHI	4th, 2006

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtu.be/svfyI6S0MDg
2	https://youtu.be/MT9MeYjG6ko
3	https://youtu.be/Q_eAIJLxo_g
4	https://youtu.be/iHrKsfw827c

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